Utilizing Pro-Bono Commercial Assets for Marine Mammal Surveys In a High Naval Activity Area in Hawaiian Waters

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LONG-TERM GOALS

The waters surrounding the State of Hawaii are high U.S. Navy activity regions with the presence of Pearl Harbor on the island of Oahu, the FORACS (Fleet Operational Readiness and Accuracy Check Site) acoustic range operated by the Hawaii Detachment of NUWC-Newark along the Waianae coast of Oahu, and PMRF (Pacific Missile Range) in the waters off the island of Kauai and the shallow waters of west Maui. Furthermore, the RIMPAC exercises (Rim of Pacific Exercises) that occur on a regular basis involve considerable Naval resources operating close to and within Hawaiian waters. The Pacific Navy is under considerable pressure from environmental groups that have initiated up to five law suits to curtail the Navy's use of active sonar for training. Perhaps the best approach in combating the various environmental concerns expressed in the different lawsuits is to gather scientific data and obtained important information on the abundance and distributions of marine mammals in the high Navy activity area of Hawaii. The ocean is large and the chances of avoiding any interaction with any sizable group of marine mammals are probably much greater than the probability of encountering marine mammals. However, the cost of negative encounters is disproportionately high in terms of negative publicity and law suits so it would be prudent to take steps to increase the odds against any encounters. So we return to the fact that basic information on the biology, natural history, and behavior of dolphins and whales that frequent waters of high Navy activities are needed in order to avoid encounters.

Marine mammal surveys around the Hawaiian Islands have been sparse and localized. In 2002, the National Marine Fisheries Services conducted a visual and acoustic survey within the Hawaiian archipelago (Barlow et al., 2004; Rankin and Barlow, 2007). Another NMFS cruise took place in February of 2009, almost 7 years since the previous one. The 2002 and 2007 surveys also took place within a specific time period and the information, while useful, is limited in temporal and spatial pattern for a specific time period in terms of season, month and year. Aerial surveys have been conducted in conjunction with the North Pacific Acoustic Laboratory Program from 2001 to 2004 (Mobely, 2002, 2003, 2004a,b). However, these aerial surveys occurred mainly around the island of Kauai, and only during the humpback whale winter season in Hawaii. The results pertained, only a specific season and in a relative localized area. Furthermore, aerial surveys are limited to daylight hours and relatively calm seas. Robin Baird from Cascadia Research have conducted brief marine mammal surveys for several years, usually once a year (see Baird et al., 1008a, b, c,d,e). His surveys tend to be short 2 weeks and a month in shallow waters and in selected waters. Certainly, more

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information is need over all four seasons and in a broader geographic region that is not restricted only to daylight hours.

The goal of this project is to perform regular, but relatively inexpensive acoustic surveys in the deep waters between Oahu and Hawaii and Oahu and Kauai on a seasonal basis using the assets of the Young Brothers Company, the largest inter-island shipper in Hawaii. Young Brothers have offered to participate with us by allowing us to board their tugs and use our acoustic instruments to collect data, on a pro-bono basis. We hope to establish a robust database of information that currently does not exist in the deep waters between islands.

OBJECTIVES

The objective of this study is to map the distribution and abundance of whales and dolphins in the deep waters between the island of Oahu and Hawaii and the island of Oahu and Kauai.

APPROACH

The basic approach is to use the assets of Young Brothers, the largest inter-island shipper in Hawaii. Tug boats towing large barges make regular runs from the economic and business center of the State of Hawaii, the city of Honolulu. Mr. Mark Houghton, Vice President of Maritime Operation of Young Brothers, has agreed to allow acoustic monitoring equipment to be located on some of their barges without charging the University of Hawaii. Such a project would allow Young Brothers to perform an interesting public service. A map of three routes between Honolulu and W. Hawaii, between Honolulu and E. Hawaii and between Honolulu and Kauai is shown in Figure 1.

The original concept was to use a 2-hydrophone array attached to the barge, which is usually about 600 m behind the tug boat to collect acoustic data which would be telemetered to the tug boat via a wireless link. However, after much discussion with the barge foreman it was decided that this concept was not workable. Now we are attaching a tow body that is attached to the barge with a hydrophone attached to the tow line. A picture of the tow body is shown in Figure 2 and other pieces of equipment are shown in Figure 3.

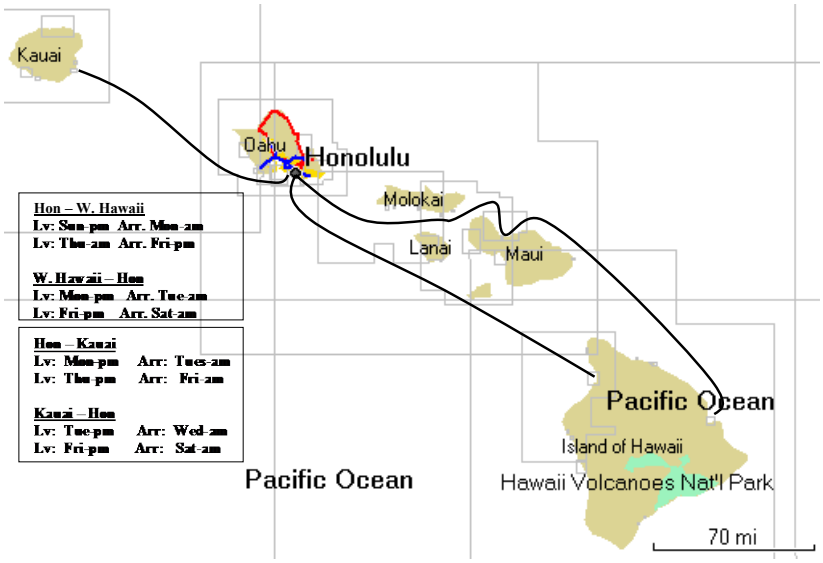

Figure 1. Map of the main Hawaiian Islands and three different Young Brothers barge route along with typical schedules between Honolulu and West Hawaii and Kauai.

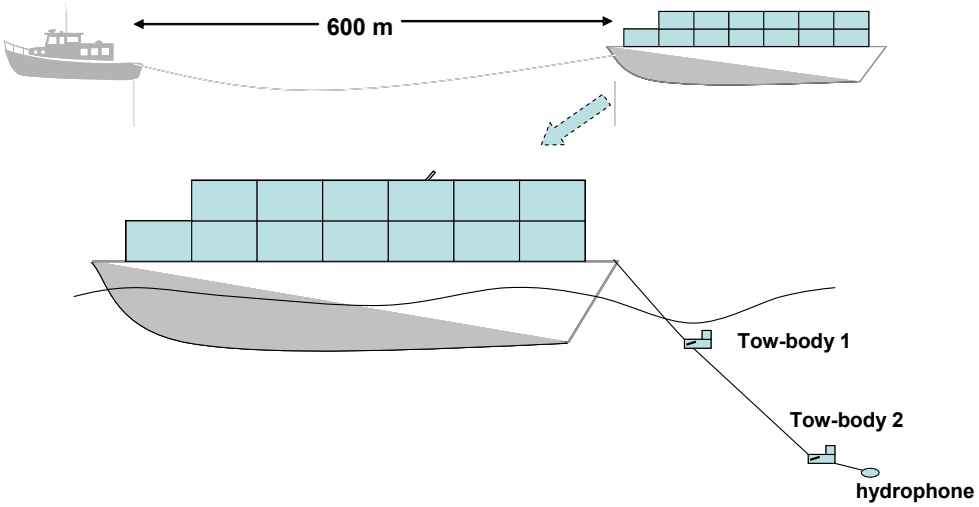

Figure 2. Experimental geometry showing towfish behind barge. The hydrophone is attached to the tow line.

Figure 3. Equipment used to monitor for marine mammals.

WORK COMPLETED & RESULTS

Towing system was modified in which two two-bodies are being used as shown in Figure 2. The two-tow body configuration allow us to get the hydrophone deeper below the barge which resulted in reduced noise level so that current results are much better after this modification. The tow bodies are constructed out of 4-in aluminum tubing with dive planes to force the tow bodies to dive as deep as possible. The two tow-body concept has been working well but required considerable time to develop.

The equipment was easily secured to the deck of the barge as shown in Figure 4 and we successfully collected data for eighteen round-trips from Honolulu of Oahu to Kawaihae Harbor on the Big Island and from Honolulu to Nawilliwilli on Kauai. These trips covered a total distance of 3244 miles at an average speed of 8 mph. Beaufort sea state during these trips ranged between 1 and 5, most time spent at a 5 or above. The sea state highlights the importance of doing acoustic surveys in these areas of low visibility conditions. During these eighteen trips, we recorded a more than 300 hours of acoustic recordings. Of these recordings, more than 90 hours have been visually and aurally inspected for calls, with a total of 635 total calls from both odontocetes and mysticetes. During some sightings, echolocation signals were also recorded as can be seen in Figure 5b. All the data collected so far has been synced with GIS, and will be compared to remotely sensed oceanographic data as shown in Figure 7. We have begun writing custom matlab programs to optimize data visualization. Once optimized, the Osprey program by David Mellinger from Oregon State University, to automatically detect whistle contours within the data will be used. Other custom programs are currently being used to detect beaked whale clicks. Finally, we are in the process of designing a self-contained tow-body that will contain all electronics and allow us to operate a remote winch from the barge.

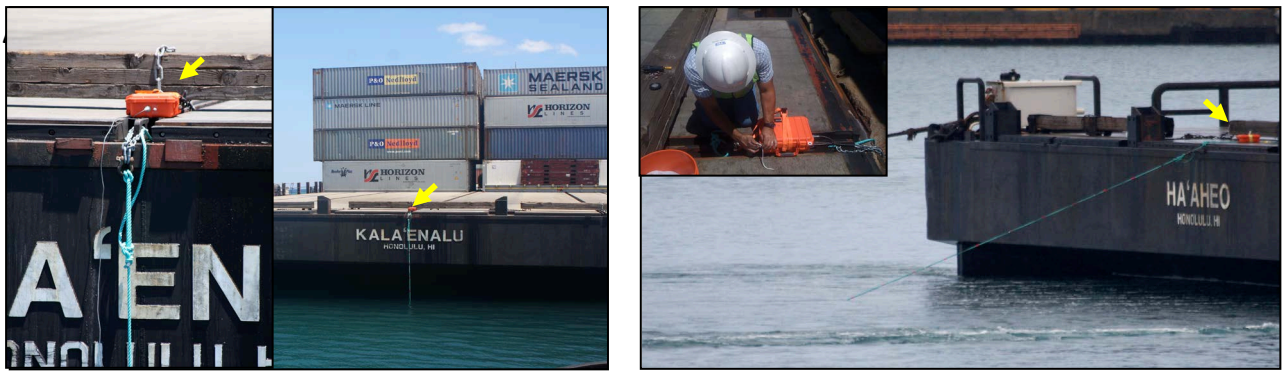

Figure 4. Acoustic recording equipment deployed on the Young Brothers barges Kala'enalu and Ha'aheo in port (A,B). Acoustic recording eqipment being secured on deck and underway at a speed of 5 knots. Yellow arrows point to the onboard electronics.

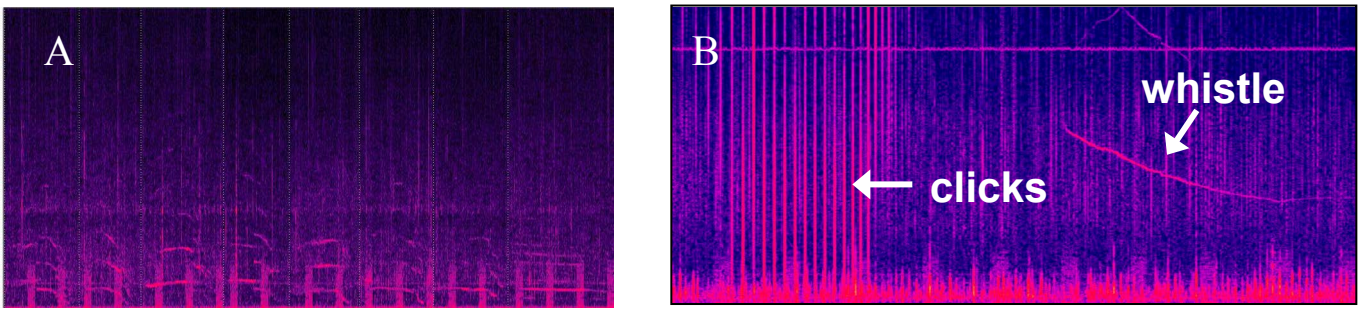

Figure 5. Acoustic recordings of humpback whales (A) and bottlenose dolphins (B). The bottlenose dolphins were visually identified.

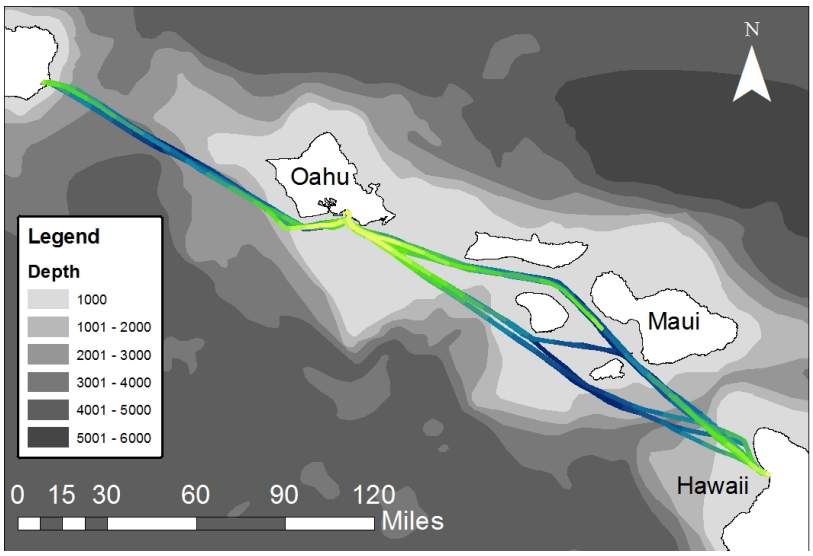

Figure 6. Acoustic tracklines between the Hawaiian Islands. Dark blue indicates night-time surveys and yellow indicates daylight survey effort.

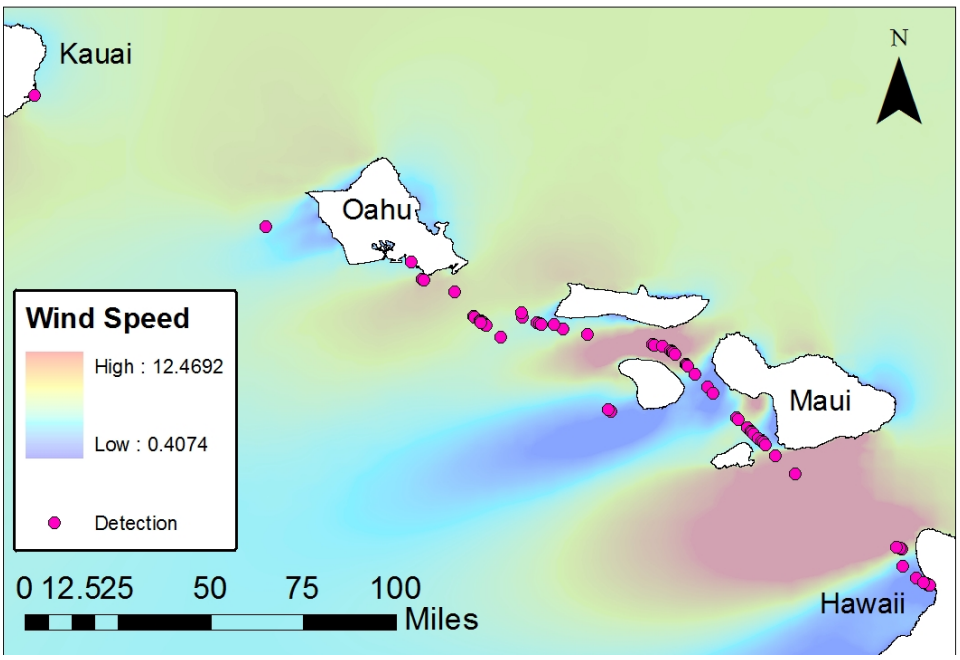

Figure 7: Acoustic and visual detections (both mysticete and odontocete) from the survey effort analyzed so far, with wind speed data from the Hawaii Wind Project.

IMPACT/APPLICATIONS

None.

RELATED PROJECTS

None.